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(54) APPARATUS FOR CHANGING THE CONTROL FUNCTION OF AN ELECTRICAL OR AN ELECTRONIC APPARATUS

(71) We, RICHARD MARK BROWN of 46 Montreal Close, Lower Wick, Worcester, formerly of 143, Malvern Road, Worcester, and CHRISTOPHER FENWICK of 5 Wilson Street, Dunston, Gateshead, County Durham, both British subjects, do hereby declare the invention, for which we pray that a patent may be granted to us, and method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to apparatus for changing the control function applied to electrical or electronic apparatus.

In particular the invention relates to an apparatus whereby the output power per channel fed to a plurality of channels is controlled by a control module which in itself is one of a number of different types of control module which may be inserted in the apparatus for use therewith. Such a system on a mechanical basis has broadly been disclosed in the "Hoover Keymatic" washing machine.

The present invention relates to an entirely electrical system to achieve control of an external multiplicity of electronic or electrical apparatus the mode of control being dependent on the choice of one of a plurality of available control modules. The apparatus of the present invention may for example be used for the control of coloured lights in a discotheque.

Known power control systems of the type used for discotheque lighting control permit the control of a fixed number of channels as defined by the design of the apparatus.

The mode of control applied by the known system is also dependent upon the design of the system, some systems applying control according to the frequency spectrum of an incoming signal, the manner of control according to the incoming signal depending upon the circuitry of the system.

A disadvantage of the known systems is that the number of channels to be controlled according to an incoming signal (an audio input signal for instance) is

determined by the design of the system as is the mode of processing the incoming signal to effect said control function.

It is an object of the present invention to provide an apparatus for the control of the power supplied to a plurality of electrical or electronic apparatus wherein firstly the number of channels controlled and secondly the manner in which the control is effected, is determined by the choice of one of a plurality of control modules.

According to the present invention there is provided an electronic apparatus for the control of the power supplied to a plurality of electro-magnetic radiation devices including: n remotely controlled power controlling and output circuits; a power source; a power input connection from which power is derived for the power controlling and output circuits; a control module selected from a plurality of control modules which effects control of or more of said ' n ' power controlling and output circuits in a manner according to the particular control function of said control module; an electrical multi-channel connection means through which the module may be connected to the said n remotely controlled power controlling circuits, to said controlled power source, said module having m controlling outputs where ' m ' can be greater or less than ' n ', any excess of controlling outputs numbering ($m-n$) being unconnected, and any excess of controllable channels numbering ($n-m$) being not controlled by the module.

The module may derive its power from the power source, or alternatively it may derive its power from a power storage device.

The present invention will now be described in greater detail by way of example with reference to the accompanying drawings, wherein:—

Figure 1 is a front elevation of a lighting control apparatus according to the present invention;

Figure 2 is a block diagram illustrating the

operation of the lighting control apparatus of Figure 1;

Figure 3 is a waveform diagram relating to the ramp generator of Figure 2; and

5 Figure 4 is a block diagram of a second embodiment of a lighting control apparatus according to the present invention.

Referring to Figure 1, power is supplied to a control unit 1 via an input socket at its rear and thus to a pair of mains fuses 2 and 3 and hence to a rocker switch 4. Each controlled channel provided by the control unit has a corresponding manual control comprising a sliding fader control 5, a black-out switch 6, an indicator lamp 7 and an output fuse 8. Six channels are provided for by the control unit of Figure 1. A manual master control 9 and master black-out switch 10 are provided to enable overall manual control of output to be effected. A socket 11 is provided to receive a control module (not shown) overall control of the control module being provided by a module master fading control 12 and a module master black-out switch 13.

25 To employ only modular control a module is engaged in the module holder 11, the manual master black-out switch 10 is set to the black-out state and the module master control is pushed to its maximum position. When manual control only is required the module black-out switch is set to the black-out state, the manual black out switch being set to its "on" position enabling the manual master and channel controls to be employed to control channel power output. It will be understood that both manual and modular control can be operated simultaneously.

40 The operation of the control unit of Figure 1 will now be explained with reference to the circuit block diagram of Figure 2 wherein control of a group of six output channels is illustrated via a mixing and master control unit 15. The mixing and master control unit 15 derives control signals from either a manual control unit 16 by means of which individual channels can be faded or a control module 17. A power supply unit 18 provides regulated power where required for the electronic circuits of the control unit the supply lines being designated 19, 20 and 21. A controlling signal input socket 22 is provided to link an external signal, such as an audio signal, to the control module 17 via a multi-connector socket 23 and plug 24. The multi-connector plug and socket provides power supplies to the control module 17 as well as the aforesaid control signal from the input socket 22 and transmits from the control module 17 control signals to the mixing and master control unit 15. The control signals from the mixing and master control unit 15 are constituted by a voltage level, said level being within a predetermined control range,

and being input to one of a series of triac firing circuits 25 there being as many firing circuits as there are controlled channels from the master control unit 15. A ramp generator 26 provides a ramp output which is synchronized with the phase of the mains power supply and is fed to the firing circuits 25. The manner of synchronization of the ramp generator 26 with supply frequency and phase is illustrated in Figure 3 wherein the ramp generator output waveform is shown at *a* the mains supply waveform being shown at *b*.

The firing circuits 25 compare the amplitude of the output signal from the ramp generator 26 with the control signals from the mixing and master control unit 15 and produce firing pulses for a corresponding plurality of triac semiconductor power control elements 27 at the instant when the amplitudes of the two input signals to the firing circuits are equal. The later in the course of a supply half cycle that the two said input signals are of equal amplitude, the lower will be the mark space conduction ratio of the triac and the lower the output power to the channel.

Each triac 27 drives a respective lamp 28 via a respective interference filter 29, the filters preventing radiation by sharp switched edges of the triac waveform. There is thus provided a firing circuit 25, triac 27 and filter 29 for each channel of the control unit.

The modules 17 each have a different control function so that the lamps 28 pulsate in accordance with the audio input signal from the terminal 22 and the control function provided for the six channels from the module 17. For example, one set of control functions provided by a module would be to cause the lamps 28 to respond to different octaves of the audio signal, the lamp of channel 1 responding to the lowest frequencies and the lamp of channel 6 responding to the highest frequencies. Alternatively the set of control functions provided by a module would be to cause the lamps 28 to respond to different instruments of the audio input.

In an alternative form of the apparatus the control module provides control signals for the lamps according to a programme set within it, such control being independent of any audio signal.

In a further alternative form, instead of the power supply unit 18 supplying power to the module 17, a power storage device is incorporated.

A second embodiment of the lighting control apparatus according to the present invention is illustrated schematically in Figure 4, wherein are shown two control modules 31 and 32 each having six output channels. Each module receives its power

from a power source (not shown). Each of the two control modules has the capability of controlling the output channels in a distinct manner. By means of a group of three channel master controls 33—36 the control outputs to a pair of selection circuits 37 and 38 of three channels each can be derived from the appropriate control module channel outputs, the proportions of said controlling outputs derived from each of the control modules being infinitely variable and dependent on the setting of the master mixing controls. The selection circuits 37 and 38 are arranged such that each follows the highest output from the appropriate master controls 33 to 36. It will be appreciated that output terminals 40 and 41 are connected to the inputs of respective mixing and master control units (not shown), each unit being similar to the unit 15 shown in Fig 2 but only having three inputs.

The above embodiment including two control modules is not limited thereto, it being possible to include a plurality of control modules in the apparatus, each control module having appropriate mixing controls associated therewith, to enable the outputs of the several control modules to be combined in any desired proportions.

WHAT WE CLAIM IS:—

1. An electronic apparatus for the control of the power supplied to a plurality of electro-magnetic radiation devices including: n remotely controlled power controlling and output circuits; a power source; a power input connection from which power is derived for the power controlling and output circuits; a control module selected from a plurality of control modules which effects control of one or more of said 'n' power controlling and output circuits in a manner according to the particular control function of said control module; an electrical multi-channel connection means through which the module may be connected to the said n remotely controlled power controlling circuits, to said controlled power source, said module having m controlling outputs where 'm' can be greater or less than 'n', any excess of controlling outputs numbering ($m-n$) being unconnected, and any excess of controllable channels numbering ($n-m$) being not controlled by the module.

2. An electronic apparatus according to claim 1, additionally including: a signal input connection via which a controlling signal may be input to the apparatus said controlling signal being fed to said control module via said multi-channel connection means.

3. An electronic apparatus according to claim 1, wherein the module derives its power from said controlled power source.

4. An electronic apparatus according to claim 1, wherein the module derives its power from a power storage device.

5. An electronic apparatus according to claim 1, including a ramp generator circuit operating at twice the frequency of the mains power supply and in phase synchronism with the mains power supply, wherein each power controlling and output circuit comprises a firing circuit which compares the output amplitude of the said ramp generator with the amplitude of a control signal and produces a pulse when its two input signals are of the same amplitude.

6. An electronic apparatus according to claim 5, wherein each power controlling and output circuit further comprises a triac semiconducting power control element arranged to be switched on by the pulses produced by said firing circuit which by virtue of the controllable phase relation between said firing circuit pulses and the mains power supply serves to control the output power fed to a load.

7. An electronic apparatus according to claim 1, including: two or more control modules each capable of providing control signals for one or more controlled channels and means to mix in any desired proportion the two or more control signals derived from the two or more control modules which correspond to a particular controlled channel or group of controlled channels.

8. An electronic apparatus for the control of the power supplied to a plurality of electromagnetic radiation devices constructed and arranged to operate substantially as herein described with reference to and as illustrated in Figures 1 to 3, or Figure 4 of the accompanying drawings.

MEWBURN ELLIS & CO.,
Chartered Patent Agents,
70—72 Chancery Lane,
London W.C.2.
Agents for the Applicants.

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COMPLETE SPECIFICATION

2 SHEETS

This drawing is a reproduction of
the Original on a reduced scale

Sheet 1



